Advanced Colloids Experiments (ACE)

Glenn Research Center

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Engineering Team: ZIN Technologies, Inc.

Objective:

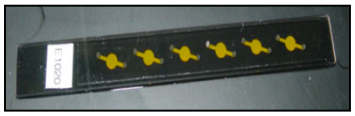
- To remove gravitational jamming and sedimentation so that it is possible to observe how order arises out of disorder and to learn to control this process. Small colloidal particles can be used to model atomic systems and to engineer new systems. Colloids are big enough (in comparison to atoms) to be seen and big enough that their evolution can be recorded with a camera. With a confocal microscope, templates, and grids, we can observe this process in 3-d and learn to control it.

Relevance/Impact:

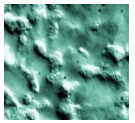
- Being able to see and control how structures form is important. Colloidal engineering is now possible. (Weitz, Harvard)
- The technology now exists to create lock-and-key reactions with the possibility of creating self-replicating non-biological structures from nanoscale building blocks using colloidal self-assembly. (Chaikin, NYU)
- With temperature sensitive polymers and microgels, the processes of melting and crystallization can be observed in 3-d at the level of the individual particles with these model “atomic” systems. (Yodh, Penn)
- This work will be done in collaboration with the European scientists (PIs) listed above.

Development Approach:

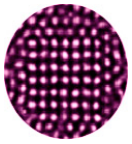
- The Advanced LMM-Colloids flight experiment will use the existing Light Microscopy Module (LMM) hardware in the Fluids Integrated Rack (FIR) aboard the International Space Station (ISS), along with a confocal microscope head and controlled sample platens. A new electronics box is planned for sample manipulation and control.
- The Advanced LMM-Colloids experiment is designed for autonomous operation through scripts and ground-based commanding. Crew time is required for the initial installation and check out in the FIR, sample change out, and removal from the FIR.
- Received drafts of significant sections of SRD for review in Preparation for SCR in Feb 2009.
- Developing plan for preliminary-ACE (PACE) 2010 test of high resolution (above 50x) capabilities using (LMM) workhorse sample cell and oil test target, and possibly specialty sample cells.



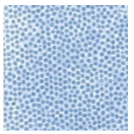
Advanced Colloids (LMM) workhorse sample cell. Microscope version of BCAT sample cells.



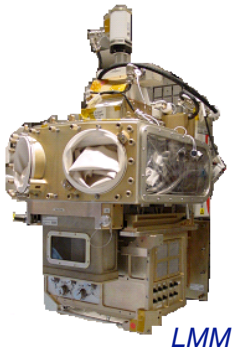
Weitz: Colloidal engineering



Chaikin: Order and patterns



Yodh: Melting and crystallization



LMM

ISS Resource Requirements

Accommodation (carrier)	Fluids Integrated Rack (FIR)/LMM
Upmass (kg) (w/o packing factor)	225 Kg for LMM-Colloids
Volume (m^3) (w/o packing factor)	0.09 LMM-Colloids
Power (kw) (peak)	0.5kw for LMM-Colloids 1.1 kw for FIR / LMM-Colloids
Crew Time (hrs) (installation/operations)	34 Hours
Autonomous Operation	2wks/module 5 modules = 10 wks
Launch/Increment	2010 PACE / 2014 ACE

Project Life Cycle Schedule

Milestones	SCR	RDR	PDR/CDR	VRR	Safety	FHA	Launch	Ops	Return	Final Report
Actual/ Baseline	10/2010	TBD	2/2011	2/2012	Phase III 2013	2013	2014	Inc. 32-35	2015	2016
Documentation	Website: eRoom:				SRD: EDMP:			Project Plan: SEMP:		

Revision Date: 10/30/2008